

## Glossary

**Aesthetics**—forest value, rooted in beauty and visual appreciation, affording inspiration, contributing to the arts, and providing a special quality of life.

**Allowable Harvest** – the calculation of the amount of forest products that may be harvested, annually or periodically, from a specified area over a stated period, in accordance with the objectives of management.

**Aspect**—the orientation of a slope with respect to the compass; the direction toward which a slope faces; north facing slopes are generally cooler than south facing slopes.

**Basal area**—a measurement of the cross-sectional area of a tree trunk in square feet at breast height. Basal area (BA) of a forest stand is the sum of the basal areas of the individual trees, and is reported as BA per acre.

**Biodiversity** - The variety of life and its processes, including the structures and functions of plants, animals, and other living organisms, especially the relative complexity of species, natural communities, gene pools, and ecosystems across a range of spatial scales from local to global.

**Biological diversity**—the variety of plants and animals, the communities they form, and the ecological functions they perform at the genetic, stand, landscape, and regional levels.

**Biological maturity**—the point in the life cycle of a tree at which there is no net biomass accumulation; the stage before decline when annual growth is offset by breakage and decay.

**Biological Monitoring** - Repeated sampling of plant and animal species occurrence and structural habitat characteristics to track baseline conditions and/or to determine pre- and post-treatment conditions in order to evaluate the effectiveness of management activities relative to established goals and objectives.

**Biomass**—the total weight of all organisms in a particular population, sample, or area; biomass production may be used as an expression of site quality.

**Board foot**—a unit of wood 1 inch thick, 12 inches long, and 12 inches wide. One board foot contains 144 cubic inches of wood.

**Bole**— the main trunk of a tree.

**Browse**- portions of woody plants including twigs, shoots, and leaves used as food by such animals as deer.

**Buffer Strip** – a forest area of light cutting where 50% or less of the basal area is removed at any one time (Ch. 132 regulations.).

**C.F.I.** – *Continuous Forest Inventory*; a sampling method using permanent plots that are visited periodically to inventory large forest properties. Its purpose is to ascertain the condition of the forest as regards health, growth, and other ecosystem dynamics. With this information, long-term forest management policy is formulated to serve the needs of its owners.

**Canopy**—the upper level of a forest, consisting of branches and leaves of taller trees. A canopy is complete (or has 100 percent cover) if the ground is completely hidden when viewed from above the trees.

**Coarse Woody Debris**—Dead and down woody material that is generally greater than 3” in diameter.

**Community**—a collection of living organisms in a defined area that function together in an organized system through which energy, nutrients, and water cycle.

**Conservation**—the wise use and management of natural resources.

**Coppice** - (even-aged or uneven-aged) any type of cutting in which dependence is placed mainly on vegetative reproduction.

**Core Habitat** - The most viable sites presently identified in MA by the Natural Heritage and Endangered Species Program to maintain populations of rare species and natural communities.

**Corridor**—a strip of wildlife habitat, unique from the landscape on either side of it, that links one isolated ecosystem “island” (e.g., forest fragment) to another. Corridors allow certain species access to isolated habitat areas, which consequently contributes to the genetic health of the populations involved.

**Crown class**—an evaluation of an individual tree’s crown in relation to its position in the canopy and the amount of full sunlight it receives. The four recognized categories are: dominant (D), codominant (C), intermediate (I), and overtopped or suppressed (S).

**D.B.H.** – *Diameter at Breast Height*; the diameter at breast height of a standing tree measured at 4.5' above the ground.

**Daylight** – verb; to cut vegetation adjacent to a road or other open area to increase solar insolation to its surface

**Den Tree** – living hollow trees that are used as homes by mammals or birds.

**Diameter-limit cut**—a timber harvesting treatment in which all trees over a specified diameter may be cut. Diameter-limit cuts often result in high-grading.

**Disturbance**—a natural or human-induced environmental change that alters one or more of the floral, faunal, and microbial communities within an ecosystem. Timber harvesting is the most common human disturbance. Windstorms and fire are examples of natural disturbance.

**Ecological Reference Condition** - A condition that represents the state of an ecosystem at a particular time in history, deemed by society to be of particular interest. In Massachusetts, such reference conditions include, but are not limited to, the field and pasture ecosystem at the height of agricultural development in the 1800s, the oak-chestnut woodland ecosystem maintained by tribes of woodland Indians prior to European arrival and settlement, or the extensive beech-maple and spruce-fir forests prior to Indian arrival. Due to changes in climate or pathogens, some reference conditions are impossible to duplicate exactly today (such as the chestnut component of oak-chestnut woodlands, or the extent of the spruce-fir forests prior to Indian arrival) and others are completely out of reach (such as the tundra and taiga conditions following the retreat of the last glaciation).

**Ecologically Viable** - Able to maintain process, function and structure over time.

**Ecology**—the study of interactions between living organisms and their environment.

**Ecosystem**—a natural unit comprised of living organisms and their interactions with their environment, including the circulation, transformation, and accumulation of energy and matter.

**Ecotype**—a genetic subdivision of a species resulting from the selective action of a particular environment and showing adaptation to that environment. Ecotypes may be geographic, climatic, elevational, or soil related. Red maples and northern red oaks are both adapted to moist soils, but can also be found on drier sites where the genetic difference is their enhanced ability to retain water.

**Edge**- the boundary between open land and woodland or between any two distinct ecological communities. This transition area between environments provides valuable wildlife habitat for some species, but can be problematic for sensitive species, due to increased predation and parasitism.

**Endangered Species** - Endangered (E) species are native species which are in danger of extinction throughout all or part of their range, or which are in danger of extirpation from Massachusetts, as documented by biological research and inventory.

**Even-aged stand**—a group of trees that do not differ in age by more than 10 to 20 years or by 20 percent of the rotation age.

**Featured Resource** – the resource that is the primary focus of management activities.

**Filter Strip** – an area of forest land, adjoining the bank of a water body, where no more than 50% of the basal area is cut at any one time (Ch. 132 regulations.).

**Ford** – a stream crossing using a stable stream bottom as the roadbed.

**Forest interior dependent species**—animal species that depend upon extensive areas of continuous, unbroken forest habitat to live and reproduce, and are susceptible to higher rates of predation and population decline when interior forest habitat is fragmented or disturbed.

**Forest types**—associations of tree species that commonly occur because of similar ecological requirements. Massachusetts three major forest types are northern hardwoods, oak/hickory, white pine and oak/pine.

**Fragmentation**—the segmentation of a large tract or contiguous tracts of forest to smaller patches, often isolated from each other by nonforest habitat. Results from the collective impact of residential and commercial development, highway and utility construction, and other piecemeal land use changes.

**Girdling**—a method of killing unwanted trees by cutting through the living tissues around the bole. Can be used instead of cutting to prevent felling damage to nearby trees. Girdled trees can provide cavities and dead wood for wildlife and insects.

**Grade** – the angle of an inclined surface as expressed in terms of percent slope: vertical rise per 100' of horizontal run.

**Growing Stock** – trees of commercial species classified as sawtimber or poletimber, excluding cull trees. *Acceptable growing stock* trees are hardwood trees which contain or have the potential to produce at least a grade 2 butt log, contain less than 20% volume loss due to defect, contain no damage or disease that would make them a poor risk to survive for at least ten years and exhibit a crown condition adequate to insure survival; softwood trees must meet the same criteria except that

butt log grade would not apply. *Unacceptable growing stock* trees are those that do not meet the foregoing criteria.

**Habitat**—the geographically defined area where environmental conditions (e.g., climate, topography, etc.) meet the life needs (e.g., food, shelter, etc.) of an organism, population, or community.

**Herbaceous** – Any seed-producing plant that does not develop persistent woody tissue above ground.

**High Risk** - stands which will not survive the next decade or in the same period, due to decay, insect or disease mortality or other factors, will suffer a net volume or value loss.

**High-grading**—a type of timber harvesting in which larger trees of commercially valuable species are removed with little regard for the quality, quantity, or distribution of trees and regeneration left on the site; often results when a diameter limit harvest is imposed.

**Horizontal structure**—the spatial arrangement of plant communities; a complex horizontal structure is characterized by diverse plant communities within a given geographic unit.

**Immature** - stands which have not reached maturity and meet none of the above criteria.

**Improvement Cutting** – a cutting made in a stand past the sapling stage for the purpose of improving composition and quality by removing trees of undesirable species, form or condition from the main canopy.

**Interior Forest** - Forest >300 m from a fragmenting edge, such as a road or powerline.

**Intermediate Cuttings** – Operations conducted in a stand during its development from regeneration stage to maturity. These are done to improve the quality of the existing stand, increase its growth and provide for earlier financial returns, without any effort directed at regeneration.

**Landing** – any place where round timber is assembled for further transport, commonly with a change in method. Generally, a cleared area where log trucks are loaded.

**Management plan**—a document prepared by natural resource professionals to guide and direct the use and management of a forest property. It consists of inventory data and prescribed activities designed to meet ownership objectives.

**Mast** – Seed produced by woody-stemmed, perennial plants, generally referring to soft (fruit) or hard (nut) mast.

**Mature** - stands which have reached the stage where the main purpose for which they were maintained has been fulfilled - either having produced the best supply of specified products or earned a specified rate of interest.

**Merchantable** – of trees, crops or stands, of a size, quality and condition suitable for marketing under given economic conditions even if so situated as not to be immediately accessible for logging. Syn., operable.

**Multiple use and value**—a conceptual basis for managing a forest area to yield more than one use or value simultaneously. Common uses and values include aesthetics, water, wildlife, recreation, and timber.

**Natural Community** - Recurrent assemblages of plants, animals, and controlling ecological processes.

**Niche**—the physical and functional location of an organism within an ecosystem; where a living thing is found and what it does there.

**Old Growth Forest** - an area of contiguous forest that: (1) shows no evidence of significant human, post-European disturbance that originated on site; (2) has a significant component of older trees that are greater than 50 percent of the maximum longevity for the particular species; (3) is at least five acres in size; and (4) has either: (i) the capacity for self-perpetuation; or (ii) the characteristics of a forest which are indicative of an old growth forest. (Note: This definition comes from proposed legislation in the Massachusetts legislature)

**Old Growth Stand** – A stand that has been formally designated as an old growth stand. These areas must meet a preponderance of the following four criteria: 1) Be of a size that is large enough to be self sustaining. 2) Show no evidence of significant post-European disturbance. 3) Should have a component of trees that are greater than 50% of the maximum longevity for that species. 4) Shall be a makeup that is self-perpetuating.

**Patch**—a small area of a particular ecological community surrounded by distinctly different ecological communities, such as a forest stand surrounded by agricultural lands or a small opening surrounded by forestland.

**Poletimber** - a tree greater than 4.9" dbh and less than sawtimber size.

**Population**—a group of individuals of one plant or animal taxon (species, subspecies, or variety).

**Preservation**—a management philosophy or goal which seeks to protect indigenous ecosystem structure, function, and integrity from human impacts. Management activities are generally excluded from “preserved” forests.

**Primary Forest** - Areas that have continually supported forest growth throughout the time of European settlement. Primary forest in MA has usually been but repeatedly over time (especially for fuelwood in colonial times), but was never converted to agricultural use such as pasture or cropland, and thus retains a more intact soil micro-climate relative to second-growth forests that occur on abandoned agricultural lands.

**Rare species**—species which exist only in one or a few restricted geographic areas or habitats or occur in low numbers over a relatively broad area; also, plant and animal species listed by the Commonwealth of Massachusetts at ‘Endangered’, ‘Threatened’, or ‘Special Concern’.

**Recreation** – Outdoor recreation is generally considered to be of two types. *Extensive recreation* is that which occurs throughout a large area and is not confined to a specific place or developed facility e.g., hunting, fishing, hiking, horseback riding, snowmobiling, cross-country skiing, etc. Syn, dispersed. *Intensive recreation* includes high density recreational activities that take place at a developed facility e.g., camp and picnic grounds and swimming beaches.

**Regeneration** – the renewal of a tree crop, whether by natural or artificial means - may be broken down into those treatments that produce stands originating from seed (high forest) or from vegetative regeneration (coppice or sprouts) and create even-aged or uneven-aged stands. Syn. reproduction.

**Release** - removal of overtopping trees to allow understory or overtopped trees to grow in response to increased light.

**Residual stand**—trees remaining following any cutting operation.

**Riparian Area** – an area in close proximity to a watercourse, lake, swamp or spring.

**Riparian Forest** - Forest occurring in conjunction with a stream, river, wetland, pond, or lake.

**Rotation** – the planned number of years between the formation or regeneration of a crop or stand and its final cutting at a specified stage of maturity.

**Salvage Cutting** – a cutting whose primary purpose is to remove trees that have been or are in imminent danger of being killed or damaged by injurious agencies.

**Sanitation Cutting** – a cutting involving the elimination of trees that have been attacked or appear in imminent danger of attack by dangerous insects or fungi in order to prevent the pests from spreading to other trees.

**Sapling** - a tree greater than 1" dbh and less than 4.9" dbh.

**Sawtimber** - a tree greater than 9.0" dbh (hardwoods) or 11.0" dbh (softwoods) having at least 8' of usable length and less than 50% cull.

**Seedling** - a young tree, less than sapling size of seed origin.

**Seed-tree** - (even-aged) removal of the old stand in one cutting, except for a small number of seed trees left singly or in groups.

**Selection** - (uneven-aged) removal of mature timber, usually the oldest and largest trees, either as single scattered individuals or in small groups at relatively short intervals, repeated indefinitely, by means of which the continuous establishment of reproduction is encouraged and an uneven-aged stand is maintained.

**Seral Stages** - the stages of ecological succession of a plant community, for example, from young to old stage; the characteristic sequence of biotic communities that successfully occupy and replace each other, alternating in the process some components of the physical environment over time.

**Shelterwood** - (even-aged) removal of the old stand in a series of cuttings, which extend over a relatively short portion of the rotation, by means of which the establishment of essentially even-aged reproduction under the partial shelter of seed trees is encouraged.

**Silviculture** – the theory and practice of controlling forest establishment, composition, structure and growth; also, a program for the treatment of a stand throughout a rotation. An even-aged system deals with stands in which the trees have no or relatively little difference in age. An uneven-aged system deals with stands in which the trees differ markedly in age.

**Site quality**—the inherent productive capacity of a specific location (site) in the forest affected by available growth factors (light, heat, water, nutrients, anchorage); often expressed as tree height at a given age.

**Site**—the combination of biotic, climatic, topographic, and soil conditions of an area; the environment at a location.

**Size Class –**

**Slash** – tops, branches, slabs, sawdust or debris resulting from logging or land clearing operations.

**Snag** – a standing dead tree, greater than 20' tall, which has decayed to the point where most of its limbs have fallen; if less than 20' tall it is referred to as a *stub*.

**Special Concern** - Special concern (SC) species are native species which have been documented by biological research or inventory to have suffered a decline that could threaten the species if allowed to continue unchecked, or which occur in such small numbers or with such restricted distribution or specialized habitat requirements that they could easily become threatened within Massachusetts.

**Species**— a subordinate classification to a genus; reproductively isolated organisms that have common characteristics, such as eastern white pine or white-tailed deer.

**Stand** – a community of trees possessing sufficient uniformity as regards composition, constitution, age, spatial arrangement or condition to be distinguishable from adjacent communities, so forming a silvicultural or management entity.

**Stand Condition –**

**Stewardship**—the wise management and use of forest resources to ensure their health and productivity for the future with regard for generations to come.

**Stocking** – the degree of occupancy of an area by trees.

**Succession**—the natural series of replacements of one plant community (and the associated fauna) by another over time and in the absence of disturbance.

**Sustained yield**—historically, a timber management concept in which the volume of wood removed is equal to growth within the total forest. The concept is applicable to non-timber forest values as well.

**T.S.I.** – timber stand improvement; a loose term comprising all intermediate cuttings made to improve the composition, constitution, condition and increment of a timber stand. The practice may be *commercial*; yielding net revenues or *pre-commercial* or *non-commercial*; where the cost of accomplishing the work exceeds the value of the products removed.

**Talus Slopes** - An uneven landform typically covered by coarse rock debris forming a more or less continuous layer that may or may not be covered by duff and litter, and thus may or may not support tree growth and other vegetation.

**Thinning** - a cutting whose purpose is to control the growth of stands by adjusting stand density.

**Threatened Species** - Threatened (T) species are native species which are likely to become endangered in the foreseeable future, or which are declining or rare as determined by biological research and inventory.

**Tolerance**—a characteristic of trees that describes the relative ability to thrive with respect to the growth factors (light, heat, water nutrients, anchorage). For instance a “shade tolerant” species may thrive at low light levels.

**Understory**—the smaller vegetation (shrubs, seedlings, saplings, small trees) within a forest stand, occupying the vertical zone between the overstory and the herbaceous plants of the forest floor.

**Uneven-aged stand**-a group of trees of various ages and sizes growing together on a site.

**Vernal or autumnal ponds** - a class of wetland characterized by small, shallow, temporary pools of fresh water present in spring and fall, which typically do not support fish but are very important breeding grounds for many species of amphibians. Some species are totally dependent upon such ponds; examples are spring peepers and mole salamanders.

**Vertical structure**-the arrangement of plants in a given community from the ground (herbaceous and woody shrubs) into the main forest canopy; a complex vertical structure is characterized by lush undergrowth and successive layers of woody vegetation extending into the crowns of dominant and codominant trees.



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## **Appendix I. Summary of comments received on October 2003 draft of the LWP Ecoregion Document, and responses from the ecoregion planning team**

Written comments on the first draft of the LWP Ecoregion document were received from 14 people. In addition, verbal comments from 5 people were recorded at the public meeting held on 9/24/03 in Athol.

Below is a summary of all comments received, along with our responses to them. In many cases, changes were also made in the second draft of the ecoregion document in response to the comments.

A number of comments were “editorial” in nature, and for the most part, these are not included in the list below. However, a substantial number of changes were made in the second draft of the document in response to these comments.

We are very appreciative of the time and attention that all reviewers devoted to this document and public review process.

### **A. List of reviewers and/or commenters:**

Sue Cloutier, Miller’s River Environmental Center, Athol  
 Ron Cloutier, Massachusetts Forestry Association, New Salem  
 Joel Dumont, Consulting Forester, South Deerfield  
 Judy Eiseman, Pelham  
 Andy Finton, The Nature Conservancy  
 David Foster, Harvard Forest  
 Al Futterman, Nashua River Watershed Association  
 Leo Garneau, Licensed Forester, Lowell  
 Carol Harley, Rochdale  
 Walt Hubbard, Hubbard Forest Industries, Inc.  
 Cinda Jones, WD Cowls, Inc.  
 Mike Leonard, Consulting Forester, Petersham  
 Bob Leverett, Friends of Mohawk Trail State Forest  
 Frank Lowenstein, The Nature Conservancy  
 Mason Phelps, Wendell  
 Heidi Ricci, Massachusetts Audubon Society  
 William Sweet, Peace and Social Concerns of Worcester Friends  
 Joe Zorzin, Licensed Forester, Peru

### **B. Comments from 9/24/03 public meeting in Athol:**

- How will we deal with management at ER boundaries?
- ER boundaries should be consistent with EcoMap
- Include educational component – e.g., management demonstration areas; general public education re: forest management.
- Connectivity of habitats and buffers – how do roads break up habitat blocks?
- Can CRs be put on state lands to assure continuity with changing administrations?

*RESPONSE: Our original intent was to keep our ecoregion boundaries consistent with those used in the BioMap project (i.e., the EPA Ecoregions). However, it became apparent that while the EPA boundaries made sense in the western part of the state, there were some serious shortcomings in the east. Conversely, the ecoregion boundaries established by the US Forest Service made good ecological sense in the eastern part of the state, but did not distinguish between some very real differences in landscape features in the west. Since this whole ecoregion planning process is based on those landscape-level features and characteristics, we felt it was necessary to use a hybrid*

*classification system that provided the “best fit” with our current knowledge about the Massachusetts landscape. Since we have an inter-agency team of resource management professionals working on these ecoregion planning documents, coordinating the management of lands that span ecoregion boundaries should not be an issue.*

*We hope to make public and landowner education an important component of future management efforts. There are many statements in the document that demonstrate this.*

*Habitat connectivity has also been addressed in the document. Regarding putting CRs on state lands, all lands under the Department of Conservation and Recreation and the Division of Fisheries and Wildlife are permanently protected for conservation purposes by Article 97 of the Massachusetts State Constitution. The only way that this dedication to conservation purposes can be removed from any parcel of land is through a 2/3 majority vote of both branches of the legislature and signature by the Governor. EOEA has a “no net loss of open space” policy whereby any legislation that includes the loss of state or municipal conservation land include the provision for the protection of open space with equal acreage and natural resource value. This policy can be overridden by legislation, however. As all environmental agency land has this protection, a conservation restriction would not add any protection as the restriction could be canceled by this same legislative process.*

### **C. Written comments and responses:**

#### **1) Comments related to the planning ‘process’**

- “every licensed forester and licensed harvester should have been notified regarding this proposal” (1)
- “reach out to get more input from more stakeholders” (2)
- “broaden your outreach” (2)
- “encourage as full distribution and public participation in future drafts as possible” (3)
- “the state has shown over the past several years no interest in public input and involvement” (5)
- “Development of broad-scale perspectives...is critical...It is essential that EOEA take a lead in this effort.” (6)
- “need to improve dissemination of information regarding this process” (6)
- “proposing broad land-use policy changes lacks consensus, adequate public process, and private industry and land owner buy-in” (7)
- “involve major players in the industry as well as their membership associations in all strategic planning efforts” (7)
- “your list of participants so far is made up of non-profit environmental groups and government agencies. That’s not balanced” (7)
- “I am outraged that private practicing consulting foresters were not asked for any input...” (9)
- “It’s important to get it right the first time...In addition, it is very important that the final Document be posted on the net so that all stakeholders may review it...” (10)
- “The public should definitely be informed of and participate in the process”  
[to achieve larger regional goals] “it would be necessary for the management plans to be coordinated between ecoregions” (12)

*RESPONSE: We agree that the public input portion of this process was too limited, and have taken steps to correct this. The original impetus for this ecoregional planning process was a requirement in the Forest Certification audit that we should develop individual state property management plans within the context of a larger “landscape-level” framework. Accordingly, the initial mailing of the draft ecoregion document was to those groups and individuals who had been involved in the Forest Certification process, plus those who had attended the 9/24/03 public meeting on the Lower Worcester Plateau Ecoregion planning process. While this did include major interest groups such as Massachusetts Association of Professional Foresters*

*and Massachusetts Wood Producers Association, it did not include all individual members of groups such as these who live and work in the LWP ER.*

*However, as word spread about this new planning process, it became apparent that there was widespread interest in such landscape-level planning in its own right – i.e., not just in relation to the Forest Certification process – and we received many more requests for copies of the document. We did our best to accommodate those requests, and also extended the deadline for comments twice to allow those parties adequate time to review the document.*

*As a result of the feedback we received, we decided to: 1) produce a second review draft incorporating many of the comments received in the first round of public review, and put that second draft out for further public review; 2) post the second draft on the internet; and 3) greatly expand our mailing list. In addition, as we move to other ecoregions in the future, we will strive to provide more complete notification and access to draft documents and public meetings, and more lead time for reviewers.*

*Finally, to address issues that cross ecoregion boundaries, we will conduct GIS and other data analyses for ALL ecoregions, plus gather statewide statistics prior to starting the planning process for the next ecoregion(s). Also, planning for possible forest reserve areas will be initially conducted at the statewide (and possibly beyond) level, thus allowing for the identification of potential reserves that span ecoregion or even state boundaries.*

## 2) Content-related comments

- “report lacks certain important aspects of forest ecology” (2)
- “tourism and recreation values of public forests...should be considered...and protected” (2)
- “final report should break down [timber size classes] into subcategories” (2)
- “references to sawtimber size classes beg for greater age differentiation” (8)
- “all forests of ‘sawtimber’ class are lumped into one big category...This seems to fly in the face of sound ecological and habitat concerns...” (13)
- “Living Waters” information should be included (3)
- report doesn’t mention if ACECs are present in ecoregion (3)
- “Discussion of long-term or even the recent dynamics in wildlife and high priority conservation species is largely absent...highlight the remarkable return and increase of native and forest-dwelling species” (6)
- recent information from Harvard Forest examining forest harvest patterns should be cited (6)
- the draft “neglects to draw one obvious conclusion...that at any given time the majority of the [pre-settlement] landscape of the Lower Worcester Plateau would have been in mature or old-growth condition...Although our modern forest is maturing, it is still comprised of many faster growing, intolerant to moderately tolerant, and successional species than 400 years ago.” (6)
- “I really like the extensive use of maps, as well as the numerous data tables. I would suggest that you include some additional maps...” (6)
- “add bark and sawdust to your list of products from sawmills” (7)
- “include [other] important functions of Massachusetts public forests...to avoid the appearance of a timber bias” (8)
- “I would like to see mention of...restoration forestry... [which] could address off-road vehicle impacts and invasive plant encroachment” (11)
- “draft seems to include valuable information...[including] emphasis on sustainability, the concern about forest health, the acknowledgement of forests as key to not only wildlife habitat, clean air and water, but also as providers of spiritual and psychological benefit” (11)

- “For understanding Green Certification, it might be helpful to have a detailed description in an appendix.” (12)
- “Harvard Forest is also a ‘special place’ worthy of mention.” (12)
- “include ‘protection of biological diversity’ as one of the attributes [of forest ecosystems]” (12)
- “include a glossary of unfamiliar terms” (12)

*RESPONSE: These ecoregional planning documents are primarily focused on sustainable ‘forest’ management, and are being produced in response to the state’s efforts to have its forest management programs “green certified”. These are not intended to be comprehensive documents addressing all aspects of ecosystem management. However, we have attempted to include various aspects of, and issues related to, forested ecosystems, and have made various changes in the document to accommodate some of the above reviewer comments. For example, we have added other values to the list of products from and functions of Massachusetts forests; we have provided more detail on tree diameter classes; included Living Waters information; included discussion of restoration forestry; added a Glossary; included Harvard Forest as a “special place”; included additional wildlife information; and made reference to Harvard Forest’s recent publication on forest harvest patterns in the region.*

### 3) Forest management approach

- “management should be focused more intensively on private lands than public forests” (2)
- “There seems to be marked preference...for encouraging harvesting of wood products as if that is the only use for forests...that just ain’t so!” (13)
- “active management on public lands should be carefully planned...demonstrate the highest standards and serve as models for private landowners” (2)
- “With regards to cutting practices on state land, there is a lot of room for increased environmental sensitivity, especially with regard to protecting wetlands...buffer zones could be larger...the state can elect to be more protective than the regulations require.” (12)
- “disturbing insinuation...that our forests need to be managed...not supported by science” (2)
- “great forestry does NOT mimic natural disturbances, yet it can work to maintain biodiversity” (5)
- “underlying rationale [related to need for more mid-seral forest] needs to be laid out quite openly...There is a need to clearly articulate rationale and logic before defining goals or launching into prescriptions for management” (6)
- “There also appears to be some optimal and desirable age-structure distribution in mind. What is this and why is it desirable?” (6)
- “We agree that there is a need for a better mix of ages. However, the approach to achieving the mix needs to be spelled out...The draft needs to address how DCR will determine the mix...of forestlands to actively manage, place under long term rotation, and to preserve.” (8)
- “Red oak is the most important commercial hardwood tree in our forest...The current level of oak harvesting is not sustainable.” (9)
- “Since red oak is being cut faster than it is growing, then conditions for wildlife are decreasing...” (9)
- “the draft document should ...[identify] sites which would benefit from restoration forestry” (11)
- “The ‘waste’ from harvesting should be left to enrich the soil and snags and large woody debris should be left as habitat.” (12)



- “protection and ‘no management’ seems to be the best policy for the health of the forests” (14)

*RESPONSE: All 3 agencies involved in this planning process are charged with managing their lands for various purposes, so while we do not mean to imply that forests “need to be” managed, we do believe that some portion of DCR and DFW lands should be managed to help achieve agency goals and mandates. The ER document assesses conditions and identifies issues in the whole ecoregion; however, we only have direct control over management on state-owned lands. We can only indirectly influence what happens on private lands. We agree that state land management should be carefully planned (hence this Ecoregion planning process) and be held to high standards – that is our goal. Where and when it’s appropriate to do so, state land management can and should exceed minimum regulatory standards.*

*We agree that the document should better articulate the rationale and basis for advocating a different mix of forest age classes (or seral stages) in the ecoregion – we have developed this section more in the second draft. Further, we have included discussion of “restoration forestry” and coarse woody debris in the second draft.*

*Regarding harvest levels of red oak, a couple reviewers indicated that the current level of red oak harvest is not sustainable. While this may be true statewide (at least for removals vs. growth of “growing stock”), this does NOT appear to be the case in the LWP Ecoregion, where FIA data suggests that only 46% of growing stock, or 34% of sawtimber volumes, are removed annually, on average. Still, we recognize the tremendous value of the northern red oak resource in this ecoregion, and that’s why we identified it as one of our management issues.*

*While forest management may not exactly duplicate the conditions brought about by “natural disturbances”, we nonetheless believe that, in some situations, it may be appropriate to manage in a way that generally mimics the result of windstorms, ice damage, and other natural disturbances since these were among the dominant influences on our forests prior to human arrival.*

#### 4) Reserves/set asides/old growth

- Some areas “should be left alone as control sites and for their own intrinsic values” (2)
- “final report should set some minimum percentage or acreage goals for reserved public forest areas” (2)
- “no recognition...of old growth or exemplary second growth” (13)
- “report also fails to mention DEM old growth policy” (2)
- “should call for long term protection of forests >110 years old” (2)
- “no mention of any old-growth or exemplary stands nor mention of “no harvest” zones” (3)
- document should “highlight the opportunity to establish a few large (e.g., 25,000+ acre) reserves, free from active human management” (6)
- “If there is one important (pre) historic feature that is missing from the [LWP] landscape it is large, quiet stretches of old forest” (6)
- “The plan also needs to address old growth and exemplary second growth” (8)
- “As much as 60,000 acres could be set aside as “wilderness areas”...in order to protect old growth areas and other areas of ecological significance” (9)
- “the draft document should advocate for an inventory of old growth forest, primary forest, and exemplary second growth forests...identify those forests least disturbed by humans and protect them from tree harvesting and development.” (11)

- “there should be old growth in places and there should be unmanaged lands.” (12)
- “...no recognition is given to old growth or exemplary second growth...At minimum some large forest areas should be set aside for no management to protect them as controls for study comparisons” (13)
- “part of the management plan should be an attempt to designate a connected network of unmanaged core areas surrounded by buffer areas managed for ecological forestry, etc.” (12)
- [Since] “the state [does] not have the ability (read funding) to manage all its lands to the same standard as was being proposed [Note: this comment related to statements made at the Federation of Women’s Clubs State Forest public meeting], the state should manage what it can manage well, and put the rest into reserves.” (12)
- “our main concern should be the protection of “Old Growth and secondary Old Growth forests... We also need to be concerned with the effects of recreation in areas of rare growth...” (14)
- [the paragraph suggesting that ‘forest managers can realize many of the habitat benefits associated with unmanaged forest landscapes’ through management] “is ‘greenwashing’...and should be removed from the document” (11)
- More detail needed on “unmanaged” areas – Where? What types? How much? Concentrating vs. dispersing unmanaged areas; “deliberate” vs. “default” reserves; how to coordinate among agencies.

*RESPONSE: We fully agree that this document must devote considerable attention to the issue of reserves, set asides, and old growth. We did not include such a section in the first draft because we were still actively discussing and developing our thoughts and proposals on this issue (including discussions with The Nature Conservancy, which has been doing substantial research on reserve establishment recently), and were simply not ready to write that section back in October.*

*Please refer to Sections III and VIII in this second draft for more information on forest reserves.*

#### 5) Need for more information

- “need for more finely detailed ecological inventories on which to base site-specific management planning” (2)
- “public lands should not be cut until [detailed inventories are conducted] and made available for public review” (2)

*RESPONSE: The detailed inventories called for in these comments cannot be conducted for the whole (and for each) ecoregion. However, in many cases, such information will be collected at the more local level as actual management plans for individual state-owned properties are developed. As part of the requirements for FSC Forest Certification, DSPR is completing maps of the forest communities on their land and DFW is completing a field ecological inventory of their land (DFW already has a forest community map and DSPR has a recently-completed continuous forest inventory).*

#### 6) Natural disturbances

- “inappropriate...to lump natural disturbances such as wind and ice with...introduced pests and diseases” (2)
- do “not group forest management with storms, insects and disease” Listing it as a “disturbance agent” implies that it is a bad thing. (7)

- “What frequency of fire do you consider to be high, and what does that portend for management prescriptions?” (8)

*RESPONSE: Forest management is conducted to meet specific mandates and/or management goals. It is, however, a form of disturbance and was included in this section for that reason. Introduced pests and diseases were placed in this section because, although caused by human actions, they can also result in forest disturbance. Fire might be considered in forest management planning, but its use is often constrained by the forest cover type or the community setting of the forest. For example, pitch pine barrens (such as the Montague Plains) require a detailed planning process to safeguard ecological processes and local residences. Other forests are less prone to catastrophic fire and a more general approach to reducing fire hazard can be taken.*

#### 7) Carbon sequestration

- “if current forest is sequestering carbon near their maximum rate, how does cutting...increase sequestration?” (2)
- “Great paragraph on carbon sequestration.” (7)
- “If [state] forests are not being actively managed...it is impossible that they are sequestering carbon at near their maximum rate.” (7)
- “we urge caution in promoting carbon sequestering as a justification for reducing the average age of the forest...the overall process is more complicated than just the young versus old tree scenario” (8)

*RESPONSE: We generally agree with these comments, and have made appropriate changes to the document to clarify the apparent inconsistency, and also convey that the state of our knowledge and understanding about carbon sequestration, especially as it relates to forest management, is still incomplete.*

#### 8) Policy and goal-related issues and needs

- “appears to be an assumption that there is a need to maximize regional biodiversity. Is this an EOEA goal, and if so, why, and which type of species?” (6)
- “A major management goal for [all] ecoregions should be the preservation of natural biodiversity” (12)
- “important issues [e.g., regeneration of red oak; development of local markets] should be addressed through more specific policy, regulatory and educational initiatives” (2)
- Do “not legislate private land use restrictions, or otherwise force the hands of private property owners” (2)
- “let us advocate for the reduction of the use of wood and paper products within the Commonwealth, and encourage increased recycling...” (11)
- “major factors threatening forests, [etc] are sprawl, forest conversion and parcelization...why not concentrate EOEA talent and effort towards landowner education and forestry outreach, legislative (Chap.61) reform, and land protection” (6)
- “Public forests – land owned by the citizens of the Commonwealth of Massachusetts – should not be considered exploitable...we do not want deforestation in Massachusetts” (11)
- [call for more] ‘local production of products and energy supplies’ [could be] “an excuse to expedite deforestation” (11)

- “continue striving for sustainable working forests on public land in the state. But...do not limit your definition of “sustainable forestry” to that of one for-profit certifying agent.” (7)

*RESPONSES: Biodiversity conservation is certainly an important goal for EOEa as well as the 3 land management agencies, however we do not have a specific goal to “maximize” regional biodiversity. Specific attempts at enhancing regional biodiversity will be driven by the possibilities and opportunities that present themselves in the subsequent development of individual land management plans for state-owned properties.*

*These Ecoregion Guidance Documents will largely be used to guide forest management activities on state-owned lands, although some of the identified issues and management goals could also apply to private lands. However, we have no intention of “legislating” or otherwise imposing restrictions on private land use as part of this process. Further, it is unlikely that we would propose regulatory changes to deal with issues such as enhancing red oak regeneration or developing local markets, although it is possible that new EOEa policies or incentives that address these issues could be developed. Educational efforts will likely receive the most attention. Educational and incentive programs are already in place for recycling. Advocating for a reduction in the use of wood products is more controversial however, since many people believe that it is more environmentally friendly to use renewable wood products rather than other materials that have hidden environmental costs related to their production and/or disposal.*

*Landowner education and forestry outreach, legislative (Chapter 61) reform, and land protection are all very important components of forest ecosystem conservation, and we hope to see continued progress in all of those areas. However, the main focus of this planning effort is to coordinate and improve the sustainable management of state-owned forest lands. At least on those lands, “exploitation” and “deforestation” are the antithesis of our general goal of sustainable, sensitive management. However, on some private lands, these concerns may be real. Education, Chapter 61 reform and zoning reform should help in this regard, but ultimately, private landowner rights will likely limit the effectiveness of state efforts to minimize practices that might be considered exploitive and unsustainable. EOEa will be convening a conference in the spring of 2004 with representatives of the major forest interests to draft an action plan on these issues.*

*Our definition of “sustainable forestry” (see Glossary) does not come from the organization that is certifying our forest management program. Further, the “standards” against which our program is evaluated were not developed by the certifying agent, but by the Forest Stewardship Council – an international organization founded and backed by a wide range of environmental, industry, professional and community groups.*

#### 9) Socio-economic factors

- “simply listing mills within the region [also foresters and loggers] does not reflect the scope of activity that actually occurs there” (4)
- the number of licensed foresters in the ER is misleading because “many are simply NOT private consulting foresters” (5)
- the focus on numbers of forest product businesses and professionals gives “a distorted view of the world and the potential uses and current economies of Massachusetts forests”. Broaden coverage to include conservation organizations, land trusts, tourism, etc. (6)
- disagrees with statement about making Massachusetts more self-sufficient in use of wood products – “exporting logs to the best markets...makes forest management a smarter economic endeavor, which will encourage more management” (5)

*RESPONSE: We used the best information we could find to list the mills, loggers, foresters, etc. operating in the ecoregion. Still, we acknowledge that such a list does not give a complete picture of the amount of forest product related “business” that occurs in the ecoregion. We have modified the text in the second draft to reflect this. Regarding the issue of exporting logs, there are several reasons why making Massachusetts more self-sufficient in the use of wood products makes environmental and economic sense. It is one of the purposes of state government to improve the livelihood of its residents. We are attempting to meet this purpose by encouraging the “value-added” economic aspects of wood products in Massachusetts. From an environmental perspective, reducing transportation of raw materials and finished products is a good thing.*

#### 10) Public-private partnerships

- “prefer to have public-private partnerships like the Peck/Hull project than a federal forest” (4)
- the state should consider the “agenda” of potential partners to assure that that any partnerships “benefit the forest and its inhabitants” (11)

*RESPONSE: We agree that more public-private partnerships (like the Peck/Hull project) are desirable, and that the “agenda” of potential partners must be considered when establishing such partnerships. The “national forest” issue does not involve the LWP ecoregion, but will likely be addressed when we deal with the northern Berkshires ecoregions.*

#### 11) Accuracy comments

- “not sure that [new CRs on lands in Brimfield and Sturbridge] were accurately mapped” (4)
- disagrees that ‘issue of forest sustainability has only recently been given the degree of attention that it deserves’; “some have been pushing hard for several years to see more sustainable forestry” (5)
- “I question [the landuse figures in Table3]” (7)

*RESPONSE: Note: In addition to the above comments, a couple reviewers provided detailed editorial-type comments on the draft document, many of which identified minor mistakes in figures, etc. We greatly appreciate these efforts to make the document more accurate, and have double-checked many statements, tables and figures, and made a number of changes as a result. We also acknowledge the efforts of people in the forestry community who have been pushing for sustainable management, and have made appropriate changes in the text to reflect this.*

#### 12) High-grading

- “One of the most important issues is high-grading...Ignoring this issue [High-grading] any longer will result in forests being further degraded” (5)
- “strongly disagree with [the document’s] rationalization for high-grading” [i.e., market conditions and inadequate recognition of economic value of long-term stewardship] because it “softpedals the problem”. “High grading occurs because some people CHOOSE to high grade” (5)
- “Up to 80% of all [Bureau of Forestry]-approved Forest Cutting Plans are exploitative high-grade cuts” (9)

*RESPONSE: We agree that high-grading (on some private forest lands) is a serious issue in the state, and we acknowledged this (and identified it as a major issue in the ecoregion) in our first draft. Current efforts in DCR are geared towards making changes in Chapter 132 (The Forest Cutting Practices Act) policy that will start to address this issue. However, we stand by our belief that market conditions and inadequate recognition of the benefits of sustainable management are contributing to this problem. Granted, landowners sometimes “choose” to high-grade, but we believe that they often do so because they believe they can make more*

*money (i.e., over the short-term) or because the benefits of long-term stewardship of their land (versus short-term exploitation) have not been adequately explained to them. This points to the need for better education of forest landowners, and perhaps greater accountability for the foresters who are working with those landowners.*

### 13) Economic issues

- “no mention of greatly improving on the economic considerations...no reason...why management of state forests can’t incorporate a business like attitude...state must prove...that they can protect...forest resources...while being profitable” (5)
- “landowners are not being paid full value for their timber” (9)
- “high-grading is financially very shortsighted” (9)
- “I would like to see financials related to the state-owned forest lands audit by Scientific Certification Systems, and also and Forest Stewardship Council-related financials” (11)

*RESPONSE: DCR is giving serious consideration to establishing a pilot project to implement the forest management called for in a completed State Forest Plan using one or more licensed professional forester from the private sector. The education of landowners will improve with the new Forest Cutting Plan form being used beginning in January of 2004 as well as the “Call Before You Cut” 800 number and other educational tools such as the several thousand copies of the Woodlot Owners Guide recently distributed to private landowners. Based on the comments made to this plan, DCR and DFW plan to add information to their web sites explaining about high grading, including the long-term financial losses this practice incurs. The FSC Forest Certification process involved competitive proposals for the work outlined by EOEA. The Scientific Certification Systems firm was selected based on this process. The \$135,000 cost for this project includes a detailed review of all the paper documentation from the three land-holding Divisions, site inspections on over 70 sites across the state, drafting of detailed conditions and recommendations on over 100 FSC criteria, and annual audits of the progress of the three Divisions for the next five years. This investment has given EOEA and its three land managing Divisions a clear blueprint to make our forest management “world class” over the next 5 years and will track our progress toward this goal during this period. For the guidance it gives the agencies charged with managing 10% of the land of the state and the information it will provide to a very interested public, we feel it was a good investment. Having Forest Certification will also help the state to market its products in new ways that will help stabilize the sale of its wood products and that may provide a premium for these sales over the long term. The experience of Quabbin Reservoir’s Certification substantiates the case that market stabilization can occur from Certification.*

### 14) Bureaucratic or operational changes and needs

- state should “require that only a Licensed Forester prepare cutting plans” and “only Licensed Foresters can be on the Forester License Board” (5)
- “current forestry establishment...hinders the needed reform because it would lose its privileges” (5)
- needed changes in FCPA are being nixed (5)
- existing harvesting laws aren’t being enforced (5)
- “Forester Licensing Board totally ignores...violations [related to high-grading]” (9)
- “Chapter 61...is a stop gap measure...landowners get in and out all the time...current enrollment...may in fact be declining” (9)
- “Chapter 61...must be improved by repealing the 8% stumpage tax and all filing fees...there should be no penalty when a landowner changes from Ch.61 to Ch.61A or Ch.61B...eliminate right of first refusal” (9)

- “Require that only MA Licensed Foresters be able to prepare and file any and all Forest Cutting Plans.” (9)
- “some money received in conjunction with forest harvests could be used to protect more land, to compensate private land owners for their cooperation with the LWP goals, and make payments in lieu of taxes...” (12)

*RESPONSE: DCR has completed an extensive public process to revise its Chapter 132 Cutting Plan policies which will begin implementation in January. These changes will clearly document the amount of high grading occurring while at the same time educate landowners and discourage them from this practice. After a trial period, DCR will have the information to assess the success of this approach and fine-tune it. DCR recently appointed a new Chief Forester who is reviewing the make-up of the Forester Licensing Board and how the reducing high grading can be incorporated into their charge. EOEA will be working with diverse interests to hold a forest conference in the spring of 2004 to formulate an action plan of “common ground” among divergent forest interests. The issue of revamping Chapter 61 or even supplementing the act with a new law that will result in a higher percentage of participation will be one of the goals of this conference.*

#### 15) Private land stewardship

- “you’re inaccurate and wrongly generalizing about [private] land management and forest health...major landowners in the state are members of the forest products industry, and ...are managing sustainably.” (7)
- “only 15% of private forest is well managed, almost all the rest...is high-graded sooner or later” (5)
- “focus should be providing guidance, technical assistance, and incentives for landowners, not broader regulations”. State employees should not “be developing plans for the ‘regulation of activities on private forest lands’”. (7)
- “provide incentives, guidelines and assistance to encourage private landowners to undertake sustainable forestry techniques and contribute to the strength of the forest products industry” (7)
- “great to encourage Chapter 61 management planning.” (7)
- “hope that more can be done, whether in terms of education efforts, direct or indirect financial remuneration, or creative new approaches, to compensate landowners for maintaining undeveloped forest land.” (11)
- [We should] “raise the bar” on expectations for forest health. (11)
- Opposed to encouraging landowners to become “green certified” (9)

*RESPONSE: We acknowledge that there may be an important difference in the way that “large” private landholders manage their lands, and the type of management that is practiced on some smaller private lands on which high-grading occurs. We changed the text in this draft to reflect this. Other than possible reforms to existing regulations like Chapter 132 (that provide some degree of regulation of forest cutting, including on private lands), we are not proposing any new “regulation of activities on private forest lands” in this ecoregion planning process. However we will pursue efforts aimed at landowner education, incentives, guidance and technical assistance. We agree that we should “raise the bar” regarding sustainable forest management; this might best be accomplished through a partnership of public and private entities, all of whom are committed to bring about this bar-raising.*

*We believe that the “Forest Certification” process results in many benefits, both to the landowner and to the citizens of the Commonwealth in general, and thus we have encouraged private forest landowners to consider having their lands certified. However, we recognize that not all landowners will have the interest or financial resources to go through that process. We still encourage those who are interested to pursue certification.*

*EOEA and DCR are currently conducting an outreach and education effort to thousands of private forest landowners in heavily forested communities across the state. This effort involves direct mailing of information on the Forest Stewardship Program and the benefits of professional forest management. All these landowners are offered the opportunity to have a Forest Stewardship Plan funded and completed by a licensed private forester. To date, the owners of 18,000 acres are having Stewardship Plans completed. These plans will also make them eligible for the Chapter 61 Program and in the past, 80% of Stewardship members entered Chapter 61.*

#### 16) Land Conservation

- “locking up land isn’t the only way to conserve biodiversity” (5)
- “pursue a private/non-profit conservation model that achieves your goals without taxpayer expense and government bureaucracy” (7)
- “include landowners and membership organizations for the forest products industry when you develop and implement the SLCP” (7)
- “Table 4 is misleading – town land is not protected under Article 97 unless...and classified land is at best only temporarily protected...you could separate the protection into two categories...” (12)

*RESPONSE: Most conservation professionals and organizations agree that the long-term conservation of biodiversity requires a combination of careful, sustainable management practices and land protection programs (including the establishment of “reserve” areas). Regarding the latter, local and statewide land trusts and conservation organizations have made a tremendous contribution to land protection efforts in Massachusetts. However, virtually all of those groups would agree that active involvement by state agencies is also crucial to the success of those efforts. Ultimately, an effective statewide land conservation program will require even more public-private partnerships. We would welcome the active participation of the membership organizations for the forest products industry in the implementation of statewide land conservation efforts.*

*Table 4 has been modified to better reflect the distinction between land that is permanently versus temporarily protected.*

#### 17) Invasives

- “common sense solutions” needed (5)
- “good forest management can help solve this problem” (5)
- “does not yet appear to be any convincing evidence that invasives represent a major problem for forest ecosystem reproduction, function, diversity or productivity...invasives are given unreasonable emphasis...devote considerably more attention to [decline of hemlock from the adelgid] than invasive plant species” (6)
- document omits the “likely important role of forest fragmentation, sprawl and logging in increasing the spread, abundance and aggressiveness of invasive forest species...calling for increased harvesting and an increase in younger age classes may well exacerbate the invasive problem” (6)
- “I would suggest that you shift the focus [regarding Hemlock Woolly Adelgid impact mitigation] from...attempting to replace habitat values lost...to evaluating the full range of potential managerial responses” (6)
- “it should be pointed out that many invasive species are much more likely to invade recently disturbed sites. Even forest management causes disturbance.” (12)
- “It would help...if common plant names were also included.” (12)



*RESPONSE:* The effects of invasive species are very large in scope and substantial efforts are being made to try to understand their long-term impacts on ecosystem functions (e.g., <http://invasives.eeb.uconn.edu/ipanel/> or <http://www.invasivespecies.gov/> or <http://www.aphis.usda.gov/ppq/ispm/> or <http://www.invasiveplants.net/> or <http://tncweeds.ucdavis.edu/esadocs.html> among many others). Many of these efforts have included details on the known impacts of invasive plants on pre-existing ecosystem functions although a great deal remains to be learned on the persistence of these impacts and their significance to both the natural and human worlds.

Common sense dictates that the best solution to potential problems associated with introduced and potentially invasive species is early detection and prevention of spread. Where these species have become established, the cost of eradication is generally prohibitive and the ecological effects of biological controls are often uncertain. Prevention of further spread requires an understanding of the vectors responsible for this spread. Initial establishment can occur both intentionally as plantings and through unintentional transport by humans, animals, or wind.

For many of the invasive plant species, disturbance of established native plant communities often provides the light and exposed mineral soil required for spreading upland invasive plant species. These disturbances include development (building homes, roads, commercial structures), some forms of motorized recreation (heavy ATV use of an area), and active forest management, which adds light and often scarifies organic layers, exposing mineral soil. For forest management in particular, preventing the spread of invasives requires advance knowledge of their presence in the proposed harvest area and either delaying harvests until invasives are removed or regular follow-ups to remove new plants as they appear in the disturbed area.

Active forestry can also help solve invasive problems. Having trained foresters on the ground can provide early detection of invasives. Prescribed fire has been used to reverse expansions of invasives (e.g., Japanese honeysuckle and Tree-of-heaven <http://tncweeds.ucdavis.edu/products/handbook/05.PrescribedFire.pdf>), although fire can also encourage some invasives. Deliberate cutting or removal of invasives can be prescribed as part of a harvest or timber stand improvement activity. Foresters are also familiar with the application of herbicides and can prescribe their use by a licensed applicator for invasive control if necessary.

We have made additions to the document to address the concerns outlined here. These include greater detail on the impacts of the exotic hemlock woolly adelgid (HWA), and a section outlining the range of management options in response to HWA currently being considered by various organizations. The list of species officially documented by the IPANE project has been updated to include common names and additional information was added in Appendix IV, including the list of 39 invasive plant species that have been evaluated by the Massachusetts Invasive Plants Working Group.

#### 18) FIA data

- FIA data is “inadequate” – “it rationalizes too little harvesting on state land, it rationalizes cutting immature trees...” (5)
- Using decimal places in removal figures “implies that it’s a rather accurate number...there is no scientifically good numbers on timber harvest” in part because “the numbers on Mass. cutting plans are off by at least 100%” (5)

*RESPONSE:* We recognize that FIA data has some limitations, but it still represents the best data that we currently have on forest conditions across the whole state. This information,

*collected by the U.S. Forest Service at approximately 14-year intervals, is derived from a combination of aerial photo interpretation and actual measurements of conditions on a number of ground plots. For the 1998 Massachusetts survey, more than 18,000 photo points, and almost 800 ground plots were measured. Still, the results are only "estimates" of true conditions, and thus should be used with appropriate caution. In general, we believe that data provides a fairly accurate picture of forest conditions statewide, and a general picture of conditions in the larger ecoregions (such as the LWP). We are in communication with the USFS to determine if we should attempt to use the data for the smaller ecoregions. We presented the average annual removal data with one decimal place because that's the way it was presented in the FIA tables. Also, since it represents an "average" of 14 estimates, it's appropriate to use a decimal place.*

#### 19) Management of specific state properties

- "only about 3% of the annual volume growth [on state forest lands] is being harvested annually...A further outrage is that very few of our state forests have any Forest Management Plan at all." (9)
- "Forest Management Plans for all 285,000 acres of state forest land must be written before any further timber sales are done" (9)
- "...the work of implementing those plans should be privatized and subcontracted to private consulting foresters." (9)
- Quabbin managers should "just admit" that there's a preference for "forest resource production" instead of allowing an old-growth landscape to develop. "There is no scientific evidence to support the notion that" a "young multi-aged diverse forest is more likely to protect against negative consequences of disturbance or stress" than a "maturing or old growth forest". (6)

*RESPONSE: As part of the Forest Certification process, these ecoregional guidance documents will be produced for all ecoregions in the state, followed by individual land management plans for the DSPR, DWSP and DFW properties in those ecoregions. Forest management activities will focus on forests where plans have been completed. However, high priority work will occur on State Forests where plans have not been completed over the next five years. It is the intent of EOEA to assist DCR and DFW to finish plans for all their holdings over the next 5 years. As noted above, DCR is examining the possibility of contracting the implementation of management called for in completed plans to private licensed foresters on a pilot basis. Regarding the role of forest management in the context of protecting the Quabbin Reservoir, the forest management plans for Quabbin and Wachusett Reservoirs should be consulted for further information.*

#### 20) "Forest Certification"

- "SCS is just one of the certifying groups...it is the most expensive...allow other certification programs equal status and opportunity. SCS certified sustainable forestry is not financially or time feasible to mom-and-pop operations." Consider the Tree Farm System as an alternative. (7)
- "The expense and chain of custody requirement of SCS and SFI would limit not improve forest management in the state." (7)
- "Green Certification is a waste of time and money...certifier's exorbitant fees preclude the small business person from getting certified...There is no economic benefit to Green Certification" (9)
- "The state spent over \$100,000 trying to get our state forests certified only to have the application rejected." (9)

*RESPONSE: SCS was selected to perform the certification audit of Massachusetts forestland through a competitive process. We believe this process has been beneficial in many ways. For example, it has resulted in a much more comprehensive planning process for state-owned*

*lands; it has jump-started the process of identifying and protecting “reserve” areas; and it has resulted in closer communication, coordination and joint planning among the 3 main land management agencies in the state. And contrary to one reviewer comment, we firmly believe that it WILL improve forest management in the state. We think it was taxpayer money well-spent. And for the record, the state’s application for certification was not rejected. We are presently in the process of complying with the “pre-conditions” identified by the certifying agent, and we expect to have a formal announcement of the state’s official certification early in 2004. Finally, we recognize that many “mom-and-pop” operations cannot afford the money or time needed to have their operations certified. In those cases, we would still encourage those landowners to learn about and practice sustainable forest management, and would encourage them to join the Tree Farm program. FSC Certification has been received by larger private landowners across the U.S. and even by groups of smaller landowners such as the recent FSC Certification of the Massachusetts Woodlands Cooperative.*

## 21) Forest fragmentation

- “you conclude that forest fragmentation is not a major issue at the present time. But you spend many paragraphs spelling out the details of this effect...reduce the paragraphs to one sentence to precede your above conclusion” (7)
- “I take issue with this statement [that forest fragmentation is not a major issue in the LWP ecoregion at the present time]...I have witnessed fragmentation which...is significant...who decides whether something is a “major issue”?” (11)
- “public ownership has not traditionally achieved your stated goal...don’t propose that state and federally owned land is the solution to fragmentation” (7)

*RESPONSE: The data on landuse changes and existing “contiguous natural lands” in the LWP ecoregion suggest that forest fragmentation is not a major issue at the present time. However, we believe that there is a very real potential for it to become one in the near future. Further, examples of local fragmentation can certainly be found in the ecoregion, as the 2<sup>nd</sup> comment above indicates. This is why we devote a fair amount of attention to this issue in this document. And while we are not proposing “public ownership” as the solution to fragmentation, the protection of large blocks of forestland through purchase does have its place in efforts to deal with this issue. Still, we believe that ultimately, we must combat fragmentation through a combination of public and private efforts (and partnerships), involving statewide and local zoning changes, acquisition of development rights (while leaving the land itself in private ownership), and some outright purchases. Further, we believe that by providing better education and incentives for sustainable forest management, we can help slow the conversion of forestland to development and other non-forest uses.*

## 22) Water resources

- “What precisely is an ORW area? And what is its significance?...watersheds are not ORWs” (12)
- “We also need to be concerned with the effects of ...runoff and pollution by some of these businesses” (14)

*RESPONSE: ORW (“Outstanding Resource Water”) is a term used in the Massachusetts Surface Water Quality Standards (314 CMR 4.04) to designate waters with exceptional socio-economic, recreational, ecological and/or aesthetic values. Typically, public drinking water reservoirs, their tributaries, and associated bordering vegetated wetlands are included in this designation. However, since state regulations include an “antidegradation” provision that prohibit water quality degradation in ORWs, activities that occur in the watershed areas that contribute to the actual ORWs may also be subject to increased environmental regulation. Accordingly, the MassGIS datalayer for ORWs includes the whole drainage area, and we have*

*also chosen to include them in these documents. However, we have changed the wording in the document to clarify the distinction between ORWs and their drainage areas.*

*We agree that runoff and pollution are important concerns in any ecoregion or watershed area. These concerns will certainly be taken into consideration in management operations on state forestlands.*

## Appendix II. Listed species and natural communities known to occur in the Lower Worcester Plateau ecoregion.

### A. Listed Species:

Taxonomic Group	Scientific name	Common Name	Grank	Srank	DFW Rank	Federal Rank
Fish	<i>Notropis bifrenatus</i>	Bridle Shiner	G5	S?	SC	
Amphibian	<i>Ambystoma jeffersonianum</i>	Jefferson Salamander	G5	S3	SC	
Amphibian	<i>Ambystoma laterale</i>	Blue-Spotted Salamander	G5	S3	SC	
Amphibian	<i>Ambystoma opacum</i>	Marbled Salamander	G5	S2	T	
Amphibian	<i>Gyrinophilus porphyriticus</i>	Spring Salamander	G5	S3	SC	
Amphibian	<i>Hemidactylum scutatum</i>	Four-Toed Salamander	G5	S3	SC	
Reptile	<i>Carphophis amoenus</i>	Eastern Worm Snake	G5	S3	T	
Reptile	<i>Clemmys guttata</i>	Spotted Turtle	G5	S3	SC	
Reptile	<i>Clemmys insculpta</i>	Wood Turtle	G4	S3	SC	
Reptile	<i>Elaphe obsoleta</i>	Rat Snake	G5	S1	E	
Reptile	<i>Emydoidea blandingii</i>	Blanding's Turtle	G4	S2	T	
Reptile	<i>Terrapene carolina</i>	Eastern Box Turtle	G5	S3	SC	
Bird	<i>Ammodramus savannarum</i>	Grasshopper Sparrow	G5	S2	T	(PS)
Bird	<i>Botaurus lentiginosus</i>	American Bittern	G4	S2	E	
Bird	<i>Circus cyaneus</i>	Northern Harrier	G5	S1	T	
Bird	<i>Cistothorus platensis</i>	Sedge Wren	G5	S1	E	
Bird	<i>Gavia immer</i>	Common Loon	G5	S1	SC	
Bird	<i>Haliaeetus leucocephalus</i>	Bald Eagle	G4	S1	E	(PS:LT,PDL)
Bird	<i>Ixobrychus exilis</i>	Least Bittern	G5	S1	E	
Bird	<i>Podilymbus podiceps</i>	Pied-Billed Grebe	G5	S1	E	
Bird	<i>Pooecetes gramineus</i>	Vesper Sparrow	G5	S2	T	
Bird	<i>Rallus elegans</i>	King Rail	G4G5	S1	T	
Bird	<i>Vermivora chrysoptera</i>	Golden-Winged Warbler	G4	S1	E	
Mammal	<i>Sorex palustris</i>	Water Shrew	G5	S3	SC	
Mammal	<i>Synaptomys cooperi</i>	Southern Bog Lemming	G5	S2	SC	
Mussel	<i>Alasmidonta undulata</i>	Triangle Floater	G4	S3	SC	
Mussel	<i>Alasmidonta varicosa</i>	Brook Floater (Swollen Wedgemussel)	G3	S1	E	
Mussel	<i>Strophitus undulatus</i>	Creeper	G5	S3	SC	
Crustacean	<i>Crangonyx aberrans</i>	Mystic Valley Amphipod	G3	S2S3	SC	
Crustacean	<i>Eubrachipus intricatus</i>	Intricate Fairy Shrimp	G5	S1	SC	
Odonate	<i>Aeshna mutata</i>	Spatterdock Darner	G3G4	S1	E	
Odonate	<i>Anax longipes</i>	Comet Darner	G5	S2	SC	
Odonate	<i>Enallagma laterale</i>	New England Bluet	G3	S2S3	SC	
Odonate	<i>Gomphus borealis</i>	Beaverpond Clubtail	G4	S2	SC	
Odonate	<i>Ophiogomphus aspersus</i>	Brook Snaketail	G3G4	S2	SC	
Odonate	<i>Somatochlora elongata</i>	Ski-Tailed Emerald	G5	S2	SC	
Odonate	<i>Somatochlora forcipata</i>		G5	S?	SC	
Odonate	<i>Somatochlora incurvata</i>		G4	S?	T	
Odonate	<i>Stylurus spiniceps</i>	A Clubtail Dragonfly	G5	S1	T	
Odonate	<i>Williamsonia fletcheri</i>	Ebony Boghaunter	G3G4	S1	E	
Odonate	<i>Williamsonia lintneri</i>	Ringed Boghaunter (Banded Bog Skimmer)	G3	S1S2	E	
Beetle	<i>Cicindela purpurea</i>	Purple Tiger Beetle	G5	S2S3	SC	
Lepidopteran	<i>Callophrys hesseli</i>	Hessel's Hairstreak	G3G4	S2S3	SC	
Lepidopteran	<i>Hemaris gracilis</i>	Slender Clearwing Sphinx Moth	G3G4	S2S3	SC	
Lepidopteran	<i>Papaipema appassionate</i>	Pitcher Plant Borer Moth	G4	S1S2	T	
Lepidopteran	<i>Rhodoecia aurantiago</i>	Orange Sallow Moth	G4	S2S3	T	

Vascular Plant	<i>Adlumia fungosa</i>	Climbing Fumitory	G4	S2	T	
Vascular Plant	<i>Amelanchier bartramiana</i>	Bartram's Shadbush	G5	S2	T	
Vascular Plant	<i>Arabis laevigata</i>	Smooth Rock-Cress	G5	S2	T	
Vascular Plant	<i>Arceuthobium pusillum</i>	Dwarf Mistletoe	G5	S3	SC	
Vascular Plant	<i>Arethusa bulbosa</i>	Arethusa	G4	S2	T	
Vascular Plant	<i>Asplenium ruta-muraria</i>	Wall-Rue Spleenwort	G5	S2	T	
Vascular Plant	<i>Carex grayi</i>	Gray's Sedge	G4	S2	T	
Vascular Plant	<i>Carex polymorpha</i>	Variable Sedge	G3	S1	E	
Vascular Plant	<i>Clematis occidentalis</i>	Purple Clematis	G5	S2	SC	
Vascular Plant	<i>Corallorhiza odontorhiza</i>	Autumn Coralroot	G5	S3	SC	
Vascular Plant	<i>Elymus villosus</i>	Hairy Wild Rye	G5	S1	E	
Vascular Plant	<i>Eriophorum gracile</i>	Slender Cottongrass	G5	S2	T	
Vascular Plant	<i>Isotria medeoloides</i>	Small Whorled Pogonia	G2	S1	E	LT
Vascular Plant	<i>Juncus filiformis</i>	Thread Rush	G5	S1	E	
Vascular Plant	<i>Liatris borealis</i>	New England Blazing Star	G5?T3	S3	SC	
Vascular Plant	<i>Lipocarpa micrantha</i>		G4	S2	T	
Vascular Plant	<i>Lygodium palmatum</i>	Climbing Fern	G4	S3	SC	
Vascular Plant	<i>Malaxis bayardii</i>	Bayard's Green Adder's-Mouth	G2	S1	E	
Vascular Plant	<i>Metarranthis pilosaria</i>	Coastal Swamp Metarranthis Moth	G3G4	S2S3	SC	
Vascular Plant	<i>Mimulus moschatus</i>	Muskflower	G4G5	S1	E	
Vascular Plant	<i>Orontium aquaticum</i>	Golden Club	G5	S1	E	
Vascular Plant	<i>Panax quinquefolius</i>	Ginseng	G3G4	S3	SC	
Vascular Plant	<i>Poa languida</i>	Drooping Speargrass	G3G4Q	S1	E	
Vascular Plant	<i>Podostemum ceratophyllum</i>	Threadfoot	G5	S2	SC	
Vascular Plant	<i>Potamogeton vaseyi</i>	A Pondweed	G4	S1	E	
Vascular Plant	<i>Prenanthes serpentina</i>	Lion's Foot	G5	S1	E	
Vascular Plant	<i>Ranunculus pensylvanicus</i>	Bristly Buttercup	G5	S2	T	
Vascular Plant	<i>Rhododendron maximum</i>	Great Laurel	G5	S1S2	T	
Vascular Plant	<i>Scheuchzeria palustris</i>	Pod-Grass	G5	S1	E	
Vascular Plant	<i>Scirpus longii</i>	Long's Bulrush	G2	S2	T	
Vascular Plant	<i>Trichomanes intricatum</i>	A Filmy-Fern	G3G4	S1	E	

## B. Natural Communities

Natural Community	Srank
Acidic Graminoid Fen	S3
Acidic Rock Cliff Community	S4
Acidic Rocky Summit/Rock Outcrop Community	S4
Acidic Shrub Fen	S3
Acidic Talus Forest/Woodland	S4
Black Gum Swamp	S2
Calcareous Rock Cliff Community	S3
Calcareous Talus Forest/Woodland	S3
Circumneutral Rocky Summit/Rock Outcrop Community	S2S3
Circumneutral Talus Forest/Woodland	S3
Deep Emergent Marsh	S4
Hemlock-Hardwood Swamp	S4
Hickory - Hop Hornbeam Forest/Woodland	S2
Highbush Blueberry Thicket	S4
High-Energy Riverbank	S3
Inland Atlantic White Cedar Swamp	S2
Kettlehole Level Bog	S2

Level Bog	S3
Major-River Floodplain Forest	S2
Northern Hardwoods - Hemlock - White Pine Forest	S5
Oak - Hemlock - White Pine Forest	S5
Oak - Hickory Forest	S4
Red Maple Swamp	S5
Ridgetop Chestnut Oak Forest / Woodland	S4
Ridgetop Pitch Pine - Scrub Oak Community	S2
Shallow Emergent Marsh	S4
Shrub Swamp	S5
Spruce-Fir Boreal Swamp	S3
Spruce-Tamarack Bog	S2
White Pine - Oak Forest	S5

**Codes:**

<b>Grank:</b>	
G2	<b>Imperiled</b> —Imperiled globally because of rarity or because of some factor(s) making it very vulnerable to extinction or elimination. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000) or acres (2,000 to 10,000) or linear miles (10 to 50).
G3	<b>Vulnerable</b> —Vulnerable globally either because very rare and local throughout its range, found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extinction or elimination. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.
G4	<b>Apparently Secure</b> —Uncommon but not rare (although it may be rare in parts of its range, particularly on the periphery), and usually widespread. Apparently not vulnerable in most of its range, but possibly cause for long-term concern. Typically more than 100 occurrences and more than 10,000 individuals.
G5	<b>Secure</b> —Common, widespread, and abundant (although it may be rare in parts of its range, particularly on the periphery). Not vulnerable in most of its range. Typically with considerably more than 100 occurrences and more than 10,000 individuals.
Q	<b>Questionable taxonomy that may reduce conservation priority</b> —Distinctiveness of this entity as a taxon at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority (numerically higher) conservation status rank.
T#	<b>Infraspecific Taxon</b> (trinomial)—The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. Rules for assigning T-ranks follow the same principles outlined above. For example, the global rank of a critically imperiled subspecies of an otherwise widespread and common species would be G5T1. A T subrank cannot imply the subspecies or variety is more abundant than the species, for example, a G1T2 subrank should not occur. A vertebrate animal population (e.g., listed under the U.S. Endangered Species Act or assigned candidate status) may be tracked as an infraspecific taxon and given a T rank; in such cases a Q is used after the T-rank to denote the taxon's informal taxonomic status.
<b>Srank:</b>	
S1	Typically 5 or fewer occurrences, very few remaining individuals, acres, or miles of stream or especially vulnerable to extirpation in Massachusetts for other reasons.
S2	Typically 6 - 20 occurrences, few remaining individuals, acres, or miles of stream or very vulnerable to extirpation in Massachusetts for other reasons.
S3	Typically 21 - 100 occurrences, limited acreage, or miles of stream in Massachusetts.
S4	Apparently secure in Massachusetts.
S5	Demonstrably secure in Massachusetts
<b>DFW Rank:</b>	
E	Endangered

SC	Special Concern
T	Threatened
<b>Federal Rank:</b>	
PS	Indicates "partial status" - status in only a portion of the species' range. Typically indicated in a "full" species record where an infraspecific taxon or population has U.S. ESA status, but the entire species does not.
LT	Listed threatened
PDL	Proposed for delisting



**Appendix III. [list of forest conservation organizations for the LWP ecoregion]).**

(to be included in final document)

## Appendix IV. Information on invasive plants.

Table 4 shows the currently documented occurrences of invasive plant species in the counties of the Lower Worcester Plateau ecoregion from the Invasive Plant Atlas of New England (IPANE) project. Data were captured by town and summarized by county. This is a trained volunteer mapping and documentation effort, and *by no means a complete survey*. (<http://invasives.eeb.uconn.edu/ipane/index.html>)

The table below lists the 39 species evaluated by the Massachusetts Invasive Plants Working Group against a carefully developed set of criteria. A description of this process and the final report are available as a .pdf download at [www.mnla.com](http://www.mnla.com). The following description of the criteria is copied verbatim from that report.

For a species to be included as a Non-native Invasive Species or as a Non-native Potentially Invasive Species in Massachusetts, it must be substantiated by scientific investigation (including herbarium specimens, peer-reviewed papers, published records and other data available for public review) to be:

1. Non-indigenous to Massachusetts.
2. Naturalized in Massachusetts.
3. Have the biologic potential for rapid and widespread dispersion and establishment in minimally managed habitats.
4. Have the biologic potential for dispersing over spatial gaps away from site of introduction.
5. Have the biologic potential for existing in high numbers away from intensively managed artificial habitats.

Further, to be included as a Non-native Invasive Species, a species must be documented to:

6. Be widespread in Massachusetts, or at least common in a region or habitat type(s) in the state.
7. Have many occurrences of numerous individuals in Massachusetts
8. Be able to out-compete other species in the same natural plant community.
9. Have the potential for rapid growth, high seed or propagule production and dissemination, and establishment in natural plant communities.

If a species meets the initial 5 criteria but does not, at this time meet Criteria 6-9 (all), it may be considered to be a Likely Invasive Species in Massachusetts if it meets at least one of Criteria 10-12. In the past, some of these species have been considered invasive in Massachusetts, at least in part because they are known to be invasive in other regions and thus expected to be so here.

10. Have at least one occurrence in Massachusetts that has high numbers of individuals forming dense stands in minimally managed habitats
11. Have the potential, based on its biology and its colonization history in the northeast or elsewhere, to become invasive in Massachusetts.
12. Be acknowledged to be invasive in nearby states but its status in Massachusetts is unknown or unclear. This may result from lack of field experience with the species or from difficulty in species determination or taxonomy.

**The following species were voted as INVASIVE in MA:**

***Aegopodium podagraria* L. Bishop's goutweed, bishop's weed, goutweed**

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*Ailanthus altissima* (P. Miller) Swingle **Tree of heaven**  
*Alliaria petiolata* (Bieb.) Cavara & Grande **Garlic mustard**  
*Berberis thunbergii* DC. **Japanese barberry**  
*Cabomba caroliniana* A.Gray **Carolina fanwort; fanwort**  
*Celastrus orbiculatus* Thunb. **Asian or, Asiatic bittersweet, oriental bittersweet**  
*Cynanchum louiseae* Kartesz & Gandhi **Black swallow-wort, Louise's swallow-wort**  
*Elaeagnus umbellata* Thunb. **Autumn olive**  
*Frangula alnus* P. Mill. **European buckthorn, glossy buckthorn**  
*Glaucium flavum* Crantz **sea or horned poppy, yellow hornpoppy**  
*Hesperis matronalis* L. **Dame's rocket**  
*Iris pseudacorus* L. **Yellow iris**  
*Lepidium latifolium* L. **broad-leaved pepperweed, tall pepperweed**  
*Lonicera x bella* Zabel [morrowii x tatarica] **Bell's honeysuckle**  
*Lonicera japonica* Thunb. **Japanese honeysuckle**  
*Lonicera morrowii* A.Gray **Morrow's honeysuckle**  
*Lysimachia nummularia* L. **Creeping jenny, moneywort**  
*Lythrum salicaria* L. **Purple loosestrife**  
*Myriophyllum heterophyllum* Michx. **Twoleaved water-milfoil, variable water-milfoil**  
*Myriophyllum spicatum* L. **Eurasian or European water-milfoil, spike water-milfoil**  
*Phragmites australis* (Cav.) Trin. ex Steud. **common reed**  
*Polygonum cuspidatum* Sieb. & Zucc. **Japanese knotweed; Japanese Bamboo**  
*Potamogeton crispus* L. **Crisped pondweed, curly pondweed**  
*Rhamnus cathartica* L. **Common buckthorn**  
*Robinia pseudoacacia* **Black locust**  
*Rosa multiflora* Thunb. **Multiflora rose**  
*Trapa natans* L. **Water-chestnut**

The following species were voted as **LIKELY INVASIVE** in MA:

*Centaurea biebersteinii* DC. **Spotted knapweed**  
*Cynanchum rossicum* (Kleopov) Borhidi **European swallow-wort, pale swallow-wort** Form:  
*Egeria densa* Planchon **Brazilian water weed**  
*Epilobium hirsutum* L. **Codlins and cream, hairy willow herb**  
*Euphorbia cyparissias* L. **Cypress spurge**  
*Hydrilla verticillata* (L.f.) Royle **waterthyme**  
*Microstegium vimineum* (Trin.) A. Camus **Japanese stilt grass, Napalese browntop**  
*Myosotis scorpioides* L. **Forget-me-not**  
*Najas minor* All. **Brittle water-nymph, lesser naiad**  
*Ranunculus repens* L. **Creeping buttercup**  
*Tussilago farfara* L. **Coltsfoot**

Among other sources, an excellent review of control methods is:

Tu, M., Hurd, C., & J.M. Randall, 2001. Weed Control Methods Handbook, The Nature Conservancy, <http://tncweeds.ucdavis.edu>, Version: April 2001.

## Appendix V. Cultural Resource Management Guidelines

### Cultural Resource Management

One of DCR's core functions is the protection of natural and cultural resources. Cultural Resource Management (CMR) is carried out within the planning bureau and includes inventory, assessment, preservation and interpretation. As with natural resources, cultural resources may be negatively affected by agency actions and programs. Through good planning and compliance with applicable laws, DCR can ensure the preservation of significant cultural resources for generations to come.

#### Staffing

DCR employs a staff archaeologist and a several preservation planners with expertise in historic buildings and landscapes. Staff provide technical assistance and planning leadership, oversee preservation projects and regulatory review processes, conduct fieldwork and develop management plans. They are also the liaison between DCR and the State Historic Preservation Office (SHPO), which in Massachusetts is the Massachusetts Historical Commission (MHC).

#### Regulatory Compliance

Cultural resources are protected from state and federally funded or approved activities under several laws including, but not limited to:

- M.G.L. Ch 9 ss 26-27c as amended by St 1988 c. 254.
- M.G.L. Chapter 38, section 6B (Massachusetts Unmarked Burial law)
- Massachusetts Environmental Policy Act (MEPA)
- Section 106 of the National Preservation Act of 1966

To comply with these laws, DCR must consult with the State Historic Preservation Office whenever a state action has the potential to impact historic or archaeological resources. In Massachusetts the SHPO is the Massachusetts Historical Commission (MHC). Cultural Resource Management staff members are available to coordinate the consultation process. In planning projects and activities that are subject to MHC review, schedules must allow for a 30 day review process.

DEM (now the Division of State Parks and Recreation) executed a Programmatic Memorandum of Agreement (PMOA) with the MHC that allows for some categorical exemptions from the review process. The PMOA is managed through CRM staff.

#### The Baseline Inventory

CRM staff is engaged in an ongoing program of inventory, survey and evaluation of cultural and archaeological resources as well as the nomination of significant sites to the State and National Registers of Historic Places. This information is maintained in the Cultural Resource Inventory, a baseline record of cultural and archaeological resources within DCR facilities. The Inventory is used to avoid or minimize impacts to sensitive cultural resources areas as well as to identify opportunities to enhance and interpret historic sites.

#### Best Management Practices for Forestry

The protection of cultural resources fits well with the Massachusetts Forest Cutting Practices Act (FCPA), and its associated Best Management Practices, which if properly applied, should result in minimal soil compaction and erosion. In addition, some state agencies (e.g., the DWSP) have internal BMPs or requirements that go well beyond the FCPA, including the requirement that low-impact logging machinery be used in certain sensitive areas. It's likely that the greatest threat to cultural resources occurs on private lands, especially when forest cutting plans are not required or are not filed.

- *Internal Review of Proposed Silviculture Projects*

Without appropriate controls, forest management programs can be detrimental to archaeological resources. Modern harvesting methods employ a wide range of heavy machinery, some of which, because of weight distribution and/or tire characteristics, can do irreparable damage to prehistoric sites. Skidding logs can further disturb the soil and associated cultural resources. Operations also entail clearing areas for landings, turn-arounds, and access roads. Those archaeological sites that lie closest to the surface can be damaged by such activities. It is these same types of sites - those that are the youngest in time (i.e., the Early, Middle and Late Woodland) - that were most susceptible to destruction by the plow of the local farmer, and thus represent a relatively scarce piece of the archaeological record.

Accordingly, the foundation of EOE's Cultural Resource Management within the broader context of the Lower Worcester Plateau Ecoregion is a process for reviewing proposed silvicultural operations. The review involves evaluating and assessing the impacts that harvesting could have on archaeological resources should they exist at any given operation.

- *Timber Sale Prescription Forms*

When appropriate (e.g., when an operation is planned for a known or predicted sensitive archaeological site), the foresters responsible for managing state forest lands within the LWP ER should submit a Timber Sale Prescription Form to a professional Archaeologist for in-house review. The form should provide a detailed narrative of the proposed operation including: location and size, description of topography, forest cover and soils, goals of silvicultural operations, equipment limitations, important plant and wildlife communities, and hydrology. Known historic features should be added to the form.

- *Site-specific Review*

The primary analytical tool employed in the review of impacts to prehistoric archaeological sites is the evaluation of site location criteria.

### *Prehistoric Sites*

At no time in prehistory did human populations roam haphazardly and endlessly across the landscape. For approximately 12,000 years local Native American populations adapted to the changing climatic and environmental conditions around them. During this time, Native Americans adapted their tool kit and strategies in order to take advantage of the new resources and opportunities the new environmental conditions afforded.

The key criteria for determining the archaeological sensitivity of a given site include: degree of slope, presence of well-drained soils and proximity to fresh water. Other variables such as aspect, availability of stone suitable for tool-making (i.e., soapstone in Petersham, argillites in the Connecticut River Valley, quartzite and quartz throughout the LWP ER), and elevation above sea level, may also be factors. When one or more of these variables are met, the locations are considered to have been an attractive for Native American habitation or subsistence activities. They are thus potentially sensitive for the existence of prehistoric sites. Accordingly such areas are classified as highly sensitive or

moderately sensitive for prehistoric resources, and specific guidelines may be required for harvesting in such areas.

### Historic sites

As noted above, within the LWP ER there are several thousand historic archaeological sites, six regions that have been classified as significant historic landscapes, and over 1500 properties listed on the National Register. These types of resources typically are not as fragile as prehistoric archaeological sites, nevertheless, depending on their condition, significance and location they may require specific management strategies to ensure their protection.

- *Harvesting Restrictions and Limitations*

For those silvicultural operations that will occur in locations that have been classified as highly or moderately sensitive for prehistoric resources, restrictions are recommended on the time of year and the types of equipment and techniques used. By employing restrictions on the harvesting operations that minimize ground disturbance, a compromise is achieved that allows the harvest to occur, while affording some protection to whatever archaeological resources may lie buried below the ground.

The following are types of restrictions/limitations that may be recommended for highly sensitive areas:

- the harvest should occur during the winter with frozen soil conditions;
- skidding should not be permitted;
- chainsaw-felling and the use of forwarders for log removal may provide the best protection of sites
- where mechanical felling and processing is desired, considerations should be given to soil disturbance and compaction; e.g., three-wheeled "tricycle" feller-bunchers may disturb the soil too much through frequent small-radius turns and high ground pressure, while tracked machines distribute machine weight and reduce compaction. Machines with extendable booms further increase options for protecting cultural resources, by reducing ground travel and compaction and allowing trees to be pulled away from cultural sites before being dropped.

For those proposed operations that are classified moderately sensitive, one or more of the above restrictions may be recommended. For those rugged upland, or previously disturbed areas that fail to satisfy the basic site location criteria, restrictions on the season of the proposed harvest or the type of equipment may not be appropriate.

In some cases, particularly with large acreage sales, portions of a lot may satisfy some, or all of the site location criteria, while other portions satisfy none. In those situations, restrictions may be recommended for the sensitive portion of the operation, while the above harvesting restrictions would not apply in the other portions.

- *Vegetation Management at Historic Sites*

Vegetation, if left to grow unchecked in and around stone foundations, and other historic structures like dams, raceways, etc., will ultimately destroy these archaeological features. Accordingly, a limited and selective program of vegetation management is recommended. This same limited program has been employed on historic sites in the former MDC Watersheds and its Reservations & Historic Sites.

Given limited resources, the control of vegetation growth in and around archaeological sites and historic buildings and structures is a high priority. The dislocation of foundation stones, and the

spalling of cement caused by root activity are among the most immediate threats to some of the cultural resources of the Commonwealth.

As a recommended site stabilization and preservation technique, vegetation management should entail:

- Removal of most small to medium sized brush, saplings, and trees from on, and within archaeological features i.e., cellar holes and their foundation walls; channelized stream beds; mill dams; and historic buildings.
- Removal shall be by cutting as close to the ground as feasible. Vegetation should not be pulled, or otherwise dislodged in a manner that would affect root systems.
- Manual felling of trees may often be the best technique for removal. Where the terrain is sufficiently level and stable to support them, the use of tracked feller-bunchers may be better. These machines have a long reach that limits the need to bring equipment too close to the structure. They hold the tree as it is cut, then pick it up to remove it, thus there is no concern about the direction of the fall. Furthermore, the tracks tend to distribute the weight, thereby limiting compaction to buried deposits.

Cutting contracts should include clauses that direct the logger to take extra care and precautions around cellar holes/foundations etc.